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(54) Title: PROGRAMMABLE METALLIZATION CELL STRUCTURE AND METHOD OF MAKING SAME

(57) Abstract

A programmable metallization cell ("PMC") comprises a fast ion conductor such as a chalcogenide-metal ion and a plurality of electrodes (e.g., an anode and a cathode) disposed at the surface of the fast ion conductor and spaced a set distance apart from each other. Preferably, the fast ion conductor comprises a chalcogenide with Group IB or Group IIB metals, the anode comprises silver, and the cathode comprises aluminum or other conductor. When a voltage is applied to the anode and the cathode, a non-volatile metal dendrite grows from the cathode along the surface of the fast ion conductor towards the anode. The growth rate of the dendrite is a function of the applied voltage and time. The growth of the dendrite may be stopped by removing the voltage and the dendrite may be retracted by reversing the voltage polarity at the anode and cathode. Changes in the length of the dendrite affect the resistance and capacitance of the PMC. The PMC may be incorporated into a variety of technologies such as memory devices, programmable resistor/capacitor devices, optical devices, sensors, and the like. Electrodes additional to the cathode and anode can be provided to serve as outputs or additional outputs of the devices in sensing electrical characteristics which are dependent upon the extent of the dendrite.